

DOCKET FILE COPY ORIGINAL

BEFORE THE
Federal Communications Commission
WASHINGTON, D. C.

RECEIVED

[MAY - 5 1994

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

In the Matter of

Amendment of the Commission's Rules to
Establish Rules and Policies Pertaining to a
Mobile Satellite Service in the
1610 - 1626.5 / 2483.5 - 2500 MHz
Frequency Bands

)
)
) CC Docket No. 92-166
)
)

To: The Commission

COMMENTS OF MOBILE DATACOM CORPORATION

Peter A. Rohrbach
Hogan & Hartson L.L.P.
555 thirteenth Street, N.W.
Washington, D.C. 20004
(202) 637-8631

May 5, 1994

No. of Copies rec'd
List A B C D E

29

TABLE OF CONTENTS

| | Page |
|--|------|
| INTRODUCTION | 1 |
| I. THE COMMISSION SHOULD REVISE ITS PROPOSED BAND SHARING SOLUTION TO PROVIDE CRUCIAL CERTAINTY TO CDMA LICENSEES, SERVICE USERS AND EQUIPMENT VENDORS | 3 |
| A. The <u>Notice's</u> Sharing Proposal Could Constitute a De Facto Assignment of Only 8.5 MHz to CDMA Use | 3 |
| B. The Commission Should Assign CDMA Licensees to the Center 11.5 MHz of the Band | 7 |
| 1. This Sharing Plan Would Not Prejudice FDMA/TDMA Applicants | 7 |
| 2. This Sharing Plan Maximizes the Commission's Flexibility For Future Spectrum Reassignments | 8 |
| 3. This Sharing Plan Is More Technologically Neutral | 11 |
| II. THE COMMISSION SHOULD TAKE OTHER ACTIONS TO ENSURE THAT RDSS SERVICE CAN CONTINUE IN A MSS ENVIRONMENT | 12 |
| A. The Commission Should Preserve The Ability of RDSS Operators to Use Space Segment at Geostationary Orbit | 12 |
| B. The Commission Should Protect the Right of RDSS Users to Obtain Service on Nondiscriminatory Terms | 13 |
| C. The Commission Should Recognize the Continuing Role of RDSS Services in Distress and Safety Communications | 14 |
| CONCLUSION | 14 |

SUMMARY

Mobile Datacom Corporation ("MDC") approaches this docket as a RDSS service provider using the RDSS/MSS band to provide positioning and data communications to governmental and private end users. We have a strong interest in the adoption of licensing rules that will permit us to continue our wideband CDMA services over either LEO space segment or geostationary packages. We intend to design terminal equipment that will operate compatibly in a MSS environment, and are meeting with CDMA LEO applicants to discuss use of their space segment in the future.

MDC's primary concern with the Notice relates to the proposed plan for sharing spectrum between CDMA and FDMA/TDMA technologies. As designed, the plan would impose substantial expense and uncertainty on wideband CDMA users. This problem arises from the proposal to assign CDMA systems to the lower segment of the band, and then to reassign 3.1 MHz of spectrum from CDMA to FDMA/TDMA if only one CDMA system is constructed by the current applicants.

The practical impact of this approach is to impose substantial additional -- and unnecessary -- costs on wideband CDMA systems. Any changes in the spectrum assigned to CDMA necessarily would result in changes to the center frequency of all wideband systems, with a corresponding requirement to retune both satellites and ground equipment. Substitution of new filters also would be required in both the satellites and terminals. Prudent operators would have no choice but to assume such a spectrum reassignment may occur, and to design their systems accordingly. They would have to build more complex satellites and ground equipment capable of operating in either an 11.35 or 8.25 MHz environment, at many millions of dollars of additional cost. Or alternatively, wideband CDMA

operators could design their systems for operation at 8.25 MHz from the outset, with a corresponding reduction in service to the public.

These problems can be reduced if CDMA licensees instead are assigned 11.35 MHz at the center of the RDSS/MSS band, and FDMA/TDMA licensees receive 2.575 MHz at both the top and bottom of the band. This approach would not prejudice FDMA/TDMA service because that technology can operate with the lower frequencies used for uplinks and the upper frequencies used for uplinks and downlinks. This approach also would permit the Commission to reassign spectrum later as necessary without requiring substantial changes to wideband CDMA systems, and with acceptable impact on preexisting ground equipment. Indeed, this plan maximizes the Commission's flexibility to decide at a later date exactly how much spectrum to reassign. Finally, this sharing plan is pro-competitive because it avoids imposing substantial costs on CDMA systems, and more fairly distributes the burden of coordination with GLONASS and radio astronomy among all LEO operators.

The Commission also should take other steps in this docket to ensure that RDSS service can continue in a MSS environment. First, the Commission should preserve the ability of RDSS operators to use space segment at geostationary orbit. This will be important if CDMA LEO systems are not built on a timely basis, or if they otherwise are operated in a manner that makes RDSS service over LEOs inefficient. Second, and related, the Commission should require LEO licensees to make bulk space segment available to RDSS service vendors like MDC at reasonable and nondiscriminatory rates. MDC is not taking a position on whether LEO operators should be considered common carriers so long as in some fashion the Commission ensures that space segment for RDSS will be available on a practical basis. Third, the Commission should clarify that to the extent that LEO

operators are required to have position determination capability, that responsibility can be met through arrangements with positioning companies like MDC.

BEFORE THE
Federal Communications Commission
WASHINGTON, D. C.

RECEIVED

MAY - 5 1994

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

In the Matter of

Amendment of the Commission's Rules to)
Establish Rules and Policies Pertaining to a)
Mobile Satellite Service in the) CC Docket No. 92-166
1610 - 1626.5 / 2483.5 - 2500 MHz)
Frequency Bands)

To: The Commission

COMMENTS OF MOBILE DATACOM CORPORATION

Mobile Datacom Corporation ("MDC"), by its attorneys, respectfully submits its comments on the Commission's Notice of Proposed Rulemaking in the above-captioned proceeding, FCC 94-11 (released Feb. 18, 1994) ("Notice").

INTRODUCTION

MDC has a vital stake in this proceeding because it is a radio determination satellite service ("RDSS") vendor in the same bands that will be used by the mobile satellite system ("MSS") applicants. 1/ MDC is using proven RDSS technology to meet pressing governmental and commercial requirements for positioning and related data communications. 2/ MDC recognizes that RDSS will continue to have co-principle status in the 1610 - 1626.5 / 2483.5 - 2500 MHz

1/ All references to MSS service here are to the MSS Above 1 GHz Service that is the subject of the Notice.

2/ MDC operates pursuant to special temporary authority pending final action on its Application for Interim Blanket License, File No. 814-DSE-P/L-93.

frequency bands. ^{3/} Our principal concern here is that the Commission's rules for MSS licensing be as compatible as possible with the needs of RDSS service vendors, so that the co-primary status of the two services can exist in practice.

For our part, MDC is actively engaged in planning for operations in a MSS environment. MDC intends to design mobile terminals that can operate in a conforming manner with other users of the spectrum, either through one of the licensed low earth orbit ("LEO") satellite systems or a geostationary ("GSO") package. MDC also has had discussions with each of the LEO applicants proposing to use CDMA technology, with the expectation that we will be able to use LEO space segment to serve our customer base.

However, revisions to the proposed MSS rules are necessary so that LEO operators can provide RDSS vendors with space segment to meet customer requirements for the most accurate positioning and cost-efficient data communications possible. In particular, the proposed CDMA/FDMA sharing plan imposes substantial and unnecessary costs on CDMA users. These costs are a product of the way the available bandwidth would initially be divided between the transmission modes, and the Commission's proposal to reassign spectrum between the modes in the future. As discussed below, this problem can be resolved if CDMA licensees are assigned the center frequencies of the bandwidth.

As the Commission proceeds, it should also take other steps to ensure that RDSS vendors are able to provide accurate and efficient positioning and data communications over either LEO or GSO satellites. These issues also are discussed briefly in these comments.

^{3/} See Notice at 27, n.86.

I. THE COMMISSION SHOULD REVISE ITS PROPOSED BAND SHARING SOLUTION TO PROVIDE CRUCIAL CERTAINTY TO CDMA LICENSEES, SERVICE USERS AND EQUIPMENT VENDORS

A. The Notice's Sharing Proposal Could Constitute a De Facto Assignment of Only 8.5 MHz to CDMA Use.

As a user of CDMA technology, MDC has misgivings regarding the large amount of spectrum that the Commission proposes to make available for FDMA/TDMA use. We believe that the Commission is being overly generous in awarding 5.15 MHz to this technology, particularly given that only one applicant intends to use it. All other applicants propose to use CDMA, and it is critical that they have adequate spectrum to meet their service requirements. In addition, the Commission should consider the impact of its sharing plan on RDSS. The Notice would require LEO operators to have position determination capability to meet distress and safety capability. 4/ When the Commission created the RDSS service, it recognized that use of the full 16.5 MHz bandwidth would substantially increase positioning accuracy. 5/ But the Notice's proposed limitation on the spectrum available for CDMA use would necessarily result in a one-third reduction in the accuracy of RDSS positioning. 6/

If the Commission nevertheless is determined to assign 5.15 MHz to FDMA/TDMA use, it becomes all the more important that the remaining 11.35 MHz be available to all CDMA users on a practical and efficient basis. Unfortunately, however, the Notice's bandwidth sharing plan is inconsistent with that end, undercutting the ability of CDMA licensees to make cost-efficient use of the spectrum.

4/ See Notice at 44, para. 86.

5/ See Second Report and Order, FCC 84-690, at 12 n.18.

6/ See Technical Submission, Attachment A.

The problem arises from the Notice's proposal to assign CDMA users to the lower segment of the band, and then to reassign 3.1 MHz of spectrum from CDMA to FDMA/TDMA if only one CDMA system is constructed by the current applicants. This reassignment apparently would occur simply upon an undefined "showing of need" by the FDMA/TDMA system, without any opportunity for new CDMA applicants to come forward. 7/

MDC believes that it is premature for the Commission to grant this spectrum preference to the FDMA system now, long before the first LEO satellite has even been launched. But more important, the Commission must recognize that -- given the way it proposes to divide the band between CDMA and FDMA/TDMA licensees -- this "conditional future" reassignment of 3.1 MHz actually is tantamount to a "de facto present" reassignment of the spectrum. At the least, the Commission's proposed sharing plan would impose substantial and unnecessary costs on wideband CDMA licensees and users.

The primary issue overlooked in the Notice is the economic consequence of imposing an uncertain frequency allocation on wideband CDMA systems. Under the Notice's proposed band split, any changes in the spectrum assigned to CDMA necessarily would result in changes to the center frequency of all wideband CDMA systems, with a corresponding requirement for retuning. Reassignment of 3.1 MHz of spectrum also would require CDMA users to substitute a different transmission filter in most cases.

These facts have serious economic consequences for wideband CDMA and RDSS. 8/ Essentially two choices exist. First, more complex wideband CDMA

7/ Notice at 19, para. 34.

8/ Narrowband CDMA technology would be less affected because as a general rule a reduction in CDMA bandwidth would result "only" in a reduction in channels. Even so, the Notice sharing plan imposes unnecessary burdens on

systems could be constructed that are capable of operating at either 11.35 or 8.25 MHz. This option would be very expensive to both LEO licensees and their customers, and thus impose a substantial competitive disadvantage on this technology. Alternatively, CDMA systems could be designed from the start for an 8.25 MHz environment. This more conservative approach would avoid incurring duplicative system costs. But it also is fundamentally at odds with the public interest benefits of a minimum 11.35 MHz CDMA bandwidth.

The Notice's sharing plan would impose large costs on both the spacecraft and terminal side of wideband CDMA systems. Manufacturers of CDMA spacecraft would have to include a capability to switch to an entirely different upconversion path to both narrow the band and retune to a new center frequency. Receive filters are among the most costly, heavy and bulky components of satellite payloads. While it is technically possible to design satellite transponders that can dynamically change their bandwidth, doing so would add even further cost and complexity to MSS systems. MDC estimates that the per satellite cost to accommodate the future reassignment of CDMA spectrum could run in the millions of dollars for each of the many LEO spacecraft. And this added complexity also would inevitably decrease reliability, imposing additional cost on system operators and users.

These same considerations also would play out in the case of ground equipment. If the CDMA center frequency shifts due to spectrum reassignment, retuning would be necessary for all field terminals and ground stations. New filters also would be required. At least (unlike the spacecraft) the ground equipment would be physically accessible to vendors and users. Even so, the Commission

narrowband CDMA systems that would be ameliorated by the revised sharing plan discussed below. See Section I.B, supra.

should not underestimate the cost of conforming ground equipment to a narrowed CDMA band environment. On the one hand, terminal equipment theoretically could be designed to include additional transmit filters and retuning capability (adding substantial size, weight and complexity to the devices, as well as hundreds of dollars to the price of each unit). Alternatively, users could be required to return terminals to the factory for retuning and filter replacement, at no small cost and inconvenience. Acquisition and demodulation equipment at each ground station also would have to be retuned.

It should be emphasized that CDMA licensees, users and equipment vendors necessarily would be required to build these costs into their systems. No single CDMA licensee will be able to count on a second CDMA system being constructed. In these circumstances each CDMA licensee would have to prepare for the possibility that only its system would be launched, and hence that it would later have to narrow operations from 11.35 to 8.25 MHz. Wideband CDMA equipment manufacturers and service users similarly must be prepared for bandwidth narrowing.

But faced with these potential costs, wideband CDMA system operators could well be driven to a second option: they could build their systems for 8.25 MHz from the start, effectively abandoning the additional 3.1 MHz granted them by the proposed band sharing rules. This approach at least would provide certainty regarding CDMA center frequency and filter requirements. But it would be patently inconsistent with the public interest objectives that have led the Commission to propose assignment of 11.35 MHz to CDMA systems in the first

place. It would mean a material restriction on wideband CDMA service capacity, as well as a further reduction in the accuracy of RDSS positioning. ^{9/}

B. The Commission Should Assign CDMA Licensees to the Center 11.5 MHz of the Band.

At the least, the discussion above demonstrates that the sharing plan in the Notice would impose substantial costs on wideband CDMA systems that would not be borne by a FDMA/TDMA operator. These cost burdens inevitably would constitute a major competitive handicap on CDMA licensees. Wideband CDMA systems -- and those like MDC who will use them -- should not be asked to bear these costs unless the countervailing need for them is overwhelming.

MDC believes that a simple solution is available to the Commission. The extra costs discussed above are not a necessary element of either the Commission's decision to permit both CDMA and FDMA/TDMA systems, or its desire for flexibility to reassign spectrum later. Those costs would be minimized if the Commission instead revises its proposed sharing plan and assigns CDMA systems 11.35 MHz at the center of the MSS band: 1612.575 MHz to 1623.925 MHz. The Commission can then assign FDMA/TDMA users 2.575 MHz at both the top and bottom of the band. In this way the CDMA center frequency would be permanently fixed at 1618.25 MHz, transmission filter issues would be substantially simplified, and there would be no need to retune any of the transmission paths.

^{9/} If only 8.25 MHz of the bandwidth is available for CDMA service, positioning accuracy is reduced by more than 50%. See Technical Submission.

1. This Sharing Plan Would Not Prejudice FDMA/TDMA Applicants

This sharing approach would not impose any unreasonable technical burdens on FDMA/TDMA systems. MDC recognizes that there is a secondary allocation for space-to-earth use in the upper portion of the RDSS band. However, as discussed in the attached Technical Submission, any such system could readily use the lower frequencies of 1610 to 1612.575 MHz for earth-to-space transmissions. The upper frequencies of 1623.925 to 1626.5 MHz can then be used for both space-to-earth and earth-to-space transmissions. From the information submitted by the FDMA/TDMA applicant, this approach does not appear to create an undue burden. It will increase the overhead slightly in the TDMA slot management, and possibly require slightly more capable frequency synthesizers. On the other hand, nothing in the FDMA/TDMA system design or architecture requires that the up and downlinks be interlaced in frequency. The overall cost impact on the FDMA/TDMA system should be minimal, particularly when compared with the large costs and efficiency losses of the sharing plan proposed in the Notice on wideband CDMA systems.

2. This Sharing Plan Maximizes the Commission's Flexibility for Future Spectrum Reassignments

By permanently fixing the center of the CDMA spectrum as proposed here, the Commission actually would be increasing its flexibility to engage in the kind of spectrum reassignment discussed in the Notice. MDC appreciates the Commission's concern that some of the proposed LEO systems may not be constructed in the end. The economic and technical issues involved are enormous.

It is appropriate to preserve flexibility to reassign spectrum between CDMA and TDMA/FDMA systems in the future. 10/

By adopting the sharing plan set out here, however, the Commission leaves itself the maximum freedom to effect such reassignments because frequency changes will not require wholesale changes to CDMA satellite and terminal equipment. For example, if only a single CDMA operator constructs, the Commission then could reassign spectrum at the two outer edges of the CDMA band segment to FDMA/TDMA without any material impact on existing MSS users. These matters are fully discussed in the Technical Submission. Briefly, because the TDMA/FDMA system would expand its frequency use incrementally from the outside in, full spectrum CDMA and the TDMA/FDMA systems would see only an incremental increase in the noise contributions to their respective systems from grandfathered equipment, and none from new equipment transmitting with reduced bandwidth. 11/ Based on Motorola's description of its system, its current noise margin could easily accommodate the trivial power at the wings of the spread CDMA signal. Similarly, the FDMA/TDMA users in the reassigned frequencies

10/ This flexibility should be available in the event that either CDMA or FDMA/TDMA systems fail to go forward. Future events may demonstrate that assignment of additional spectrum to CDMA systems beyond the initial 11.35 MHz is in the public interest.

11/ We would propose that equipment already in the field be "grandfathered," and that only new CDMA equipment operate with its transmitting bandwidth reduced. While this solution would cause minor degradation to the single CDMA operator because its space channels would be broader than necessary, the expense and uncertainty to the CDMA operator and its users still would be far less than under the Notice proposal.

would not have a material impact on grandfathered CDMA users because the FDMA energy would essentially be spread over the remaining CDMA spectrum. 12/

In contrast, if the sharing plan in the Notice is adopted, the Commission would have to require a very substantial "showing of need" by the FDMA/TDMA operator to justify the disruption of CDMA use that would occur by virtue of spectrum reassignment. Ironically, in that sense the Notice proposal actually could end up constraining the Commission's reassignment flexibility. We also note that if the Commission centers CDMA licensees in the band, then the impact of reassignment on narrowband CDMA could be reduced because fewer CDMA channels could be lost in that process. This matter is discussed further in the attached Technical Submission. 13/

Moreover, MDC's sharing plan would leave the Commission the flexibility to decide later just how much frequency to reassign, whether 3.1 MHz or something less. In contrast, if the Commission adopts its proposed band split, CDMA vendors will have to make investments now in transmitters that operate in either 8.25 MHz or 11.5 MHz environments. The Commission will not be able to choose a different bandwidth later without mooted all of this investment.

Indeed, MDC's sharing plan ultimately minimizes the need for the Commission to decide today whether reassignments necessarily should be favored in the future at the expense of potential new applicants. Again, MDC is troubled by the Notice's presumption that if only one of the proposed CDMA systems is built, an

12/ The exception would be when FDMA/TDMA capacity limits are being approached on all FDMA channels. However, this usage level is unlikely to be reached during the period when the grandfathered terminals are in use.

13/ As discussed in Section I.B.3 below, narrowband CDMA also benefits because coordination burdens are shared more equitably among the competing LEO technologies.

FDMA/TDMA system can claim additional frequencies immediately upon an undefined "showing of need." It would seem more in the public interest to allow a new CDMA applicant the opportunity to apply for the vacant spectrum. If the Commission adopts MDC's proposed sharing plan, the Commission will be free to reserve judgment on this issue because how this "leftover" spectrum is assigned will not impact the centering frequency or filters of an initial wideband CDMA system.

3. This Sharing Plan Is More Technologically Neutral

The Commission presumably does not intend to favor one MSS technology over another in its rules; indeed, the Commission should hope for vigorous market competition between CDMA and FDMA/TDMA systems. We already have demonstrated above that the Notice's sharing plan would impose large and unnecessary costs on wideband CDMA operators alone. In that sense our proposal to locate the CDMA users in the band center is clearly pro-competitive. From our perspective as a possible user of CDMA LEO space segment, the proposal would reduce the costs and increase the quality of the space segment available to us from the LEO vendors. This in turn would permit MDC and other service providers to offer the most efficient service possible, and in particular to preserve the accuracy of RDSS positioning services.

The Commission should also give weight to another pro-competitive attribute of our plan. As the Commission realizes, the lower half of the RDSS/MSS band is burdened by coordination issues with GLONASS and the radio astronomy community. However, the responsibility of meeting necessary coordination obligations now or in the future should fall on all MSS providers. An FDMA/TDMA system should not be favored with premium spectrum at the upper band where it alone is exempt from sharing this problem. The plan proposed here more equitably allocates the coordination burden across all competing systems. This important

factor avoids disproportionate impact on both wideband and narrowband CDMA systems, and allows the market to decide among the various technologies.

In sum, if the Commission locates CDMA use in the center of the RDSS/MSS band, it will meet public interest requirements for a minimum 11.35 MHz CDMA assignment, avoid unnecessary CDMA retuning and filter costs, increase its future flexibility with regard to frequency reassignment, and more equitably spread coordination burdens among competitors. As a future user of this spectrum, MDC urges the Commission to adopt the sharing plan set out here.

II. THE COMMISSION SHOULD TAKE OTHER ACTIONS TO ENSURE THAT RDSS SERVICE CAN CONTINUE IN A MSS ENVIRONMENT

A. The Commission Should Preserve The Ability of RDSS Operators to Use Space Segment at Geostationary Orbit

The Notice proposes to leave the current RDSS rules in place with the clarification that "RDSS space station applicants must demonstrate that any proposed system is technically compatible" with all authorized MSS systems. ^{14/} MDC understands this statement to mean that RDSS packages may be operated at geostationary orbit, notwithstanding the proposed prohibition on the use of these frequencies for MSS service from GSO satellites, so long as the RDSS operations do not interfere with those of the LEOs. ^{15/}

As discussed elsewhere, MDC has had discussions with the CDMA LEO applicants looking towards the possible use of their space segment for MDC's positioning and data services. Assuming that those systems are built promptly -- and depending upon the rules adopted in this proceeding -- MDC believes it will

^{14/} Notice at 27, n.86.

^{15/} See Notice at 12, para. 20.

have the option of transitioning its service to the LEOs at the end of life of the current RDSS packages on GTE Spacenet GSO satellites.

We are confident, however, that we also could operate satisfactorily from new GSO satellites without interference to LEO operations. We understand the Commission's decision not to allow MSS operations in this band at GSO to be based primarily on the desire for MSS competition between AMSC and the new LEO entrants. For the record, we would note that MDC is able to offer its positioning and data services equally well at GSO. In particular, to the extent that the Commission is concerned about transmission delay time as a potential problem with GSO service, this concern is not relevant to non-voice services such as those of MDC. We also disagree with the suggestion that GSO satellites do not provide adequate coverage to Alaska. We have demonstrated that our service can operate successfully to at least 72 North Latitude (100 miles into the Arctic Ocean). ^{16/}

In any event, however, the concerns expressed in the Notice regarding AMSC's application are less relevant to MDC so long as the Commission does not unreasonably burden our own ability to operate RDSS space segment at GSO. We do not understand the Notice to impose any such burdens beyond the demonstration of technical compatibility noted above. MDC is confident that it will be able to satisfy this requirement and operate without interference to MSS operators.

B. The Commission Should Protect the Right of RDSS Users to Obtain Service on Nondiscriminatory Terms

MDC will not take a position here on whether MSS space segment vendors necessarily should be classified as conventional common carriers.

However, because we will be dependent on the LEO licensees for space segment (or

^{16/} See Technical Submission.

face the requirement that any GSO package deployed for us not interfere with the LEOs), it becomes important that the LEO operator or operators not have leverage to deny us service at reasonable and nondiscriminatory rates.

In particular, LEO licensees should be required to make "bulk capacity" space segment available for resale on reasonable terms and conditions, including increments suitable for data and positioning services. It would not be satisfactory if service vendors like MDC only were able to purchase the switched per minute services of the LEOs and resell those for data applications. In those circumstances the cost of RDSS service would be prohibitive.

C. The Commission Should Recognize the Continuing Role of RDSS Services in Distress and Safety Communications

The Notice states that although the MSS applicants "have not indicated that they plan to use their systems for extensive distress and safety communications, we have proposed that these systems have position determination capability." ^{17/} Apparently the Commission wants the LEOs to have the ability to meet their obligations relating to maritime distress signals, but does not intend to require the systems to provide RDSS service per se. MDC assumes that nothing in this section of the proposed rules is meant to prohibit a LEO system from arranging with positioning companies such as our own to meet their RDSS-related obligations. We suggest that this point be clarified in the final rules.

CONCLUSION

MDC emphasizes that it supports the Commission's goal to foster LEO systems. However, the economics of such systems are daunting to say the least, and many technical questions remain open. The Commission should keep in mind

^{17/} Notice at 44, para 86.

that crucial RDSS service requirements exist now that can be met on an inexpensive and high quality basis whether or not the proposed LEO systems go forward later in the decade. Much progress has been made in RDSS technology since the Commission adopted its RDSS rules nearly eight years ago. As RDSS service now comes to fruition, the Commission should ensure that LEO systems can facilitate that service as space segment vendors. In particular, the Commission should ensure that adequate CDMA spectrum remains available -- in practice as well as in theory -- for RDSS/MSS requirements.

Respectfully submitted,

Mobile Datacom Corporation

By 

Peter A. Rohrbach
Hogan & Hartson
555 13th Street, N.W.
Washington, D.C. 20004
(202) 637-8631

Its Attorneys

May 5, 1994

Technical Attachment to MDC Comments

This attachment provides additional technical comments supporting the frequency sharing plan proposed in MDC's response to the Notice of Proposed Rulemaking. I have read the response and endorse the proposal it presents, and agree with the concerns it expresses. My responsibilities at MDC include modifying our system to operate in an acceptable way with other licensed users of the RDSS frequency bands. The rules proposed by the FCC in the Notice have a substantial impact on that effort.

Mobile Datacom Corporation (MDC) has a substantial interest in the outcome of the allocation and operating rules for the RDSS/MSS frequencies. MDC intends to design and have manufactured mobile terminals that can operate in a conforming manner with other uses of the spectrum, either through one of the licensed LEO systems, or through licensed GSO spacecraft. We believe that substantial importance should be attached to establishing a single frequency allocation and set of operating rules for the band, that don't change based on possible future actions of others, so that terminal development and testing can begin immediately.

The FCC proposes to split the RDSS band into a CDMA portion, 1,610.0 - 1,621.35 MHz, and a TDMA/FDMA portion, 1,621.35 - 1,626.5 MHz¹. However, under the proposed rules, this allocation changes if at some future time it is decided that only a single CDMA system will actually use the spectrum². According to the language in the NPRM, such a change will occur "automatically ... without hearing", even if a CDMA system is in orbit and operating. This ambiguousness concerns us because we will have made a substantial investment in mobile terminals, potentially in space systems, and ground stations for our CDMA system. Changing the rules at such a late date will have a significant financial impact on our customers. There are several reasons for this.

To accommodate a potential narrowing of the bandwidth, manufacturers of terminals and spacecraft must include additional high power filters for 8.25 MHz operation that would replace the 11.35 filters, if the CDMA bandwidth is reduced. (Alternatively, the terminals would be sent back for a factory refit, also expensive and inconvenient to customers. This isn't an option for spacecraft.) Transmit filters are among the most costly, heavy, and bulky components of the mobile terminals and the satellite payloads. While it is technically possible to design mobile terminals and satellite transponders that can dynamically change their bandwidth, doing so would further increase the cost and complexity of the systems. This could add hundreds, or perhaps thousands, of dollars to each terminal, and potentially millions of dollars to each satellite. For LEO systems that use many spacecraft, this could substantially increase the cost

¹ See NPRM CC Docket No. 92-166, Notice, at 18, n. 32.

² Notice at 19, n. 33.

of their getting into service. Adding this complexity also decreases the reliability of both terminals and satellites.

Under the current FCC proposed spectrum split, changing the bandwidth in the future will also require all full band CDMA systems to adjust the center frequencies of their systems, since the center of the present 11.35 MHz would be at 1,615.675 MHz and the center of a reduced CDMA bandwidth will be at 1,614.125. This means retuning all field equipment, satellites, and the acquisition and demodulation equipment at each ground station. Not doing so will cause significant CDMA interference into the TDMA system that moves into the vacated spectrum, and it will increase substantially the interference from the TDMA system into the CDMA receivers. This reduces the capacity of both systems, driving costs up to consumers.

To reduce the impact of the band splitting proposed by the FCC to the full band LEO applicants, and to limit the degradation to positioning services³, MDC suggests an alternative partitioning. Rather than placing the TDMA/FDMA applicants totally in the upper portion of the RDSS band, MDC proposes that the TDMA/FDMA spectrum be split such that half of it is at the bottom of the band, and the other half is at the top. We believe this proposal reduces the complexity associated with expanding one group's spectrum with respect to the others', provides a means for obtaining maximum positioning accuracy for those providers who choose to focus on that aspect of mobile services, and does not unduly put the burden of the interaction with Glonass and Radio Astronomy on only one group of applicants.

This proposal simplifies the reassignment of the CDMA frequencies to TDMA/FDMA use because it makes changing center frequencies unnecessary for the CDMA systems. Under this proposal, if only a single CDMA system goes into operation, we believe that the use of the spectrum by the TDMA/FDMA operators could expand without the CDMA operator modifying their existing mobile equipment⁴. Since the TDMA/FDMA system would expand their frequency use incrementally from the outside in, full spectrum CDMA and the TDMA/FDMA types of systems will see only incremental increases in the noise contributions to their respective

³ Limiting the bandwidth to 8.25 MHz has a negative effect on MDC's, or any other CDMA applicant's, ability to provide the highest quality RDSS service through LEO space segment providers. As has been well established previously, and as the the FCC itself stated in allocating the RDSS band, using the full 16.5 MHz RDSS bandwidth offers the greatest RDSS positioning accuracy. Reducing the bandwidth available to 8.25 MHz decreases the accuracy by more than 50%. Since a key element of the importance of RDSS is accurate positioning, reducing the bandwidth degrades the quality of RDSS service.

⁴ Instead, we would propose that mobile equipment already in the field would be "grandfathered" until it's useful life ended, and only new equipment sold by the sole operating CDMA player would have its transmitting bandwidth reduced. While this solution still causes some degradation to the CDMA operator because its space channels are broader than they need to be, the expense and uncertainty to a CDMA operator is far less than that which follows under the present FCC proposal.

systems. (Additionally, a narrowband CDMA system might also be able to vacate only two of their channels rather than three required under the present FCC proposal.) Consider the different effects an incremental transition from one type of modulation to another has.

TDMA/FDMA systems suffer degraded service due to an increase in total background noise power. The interference caused by CDMA systems into an FDMA system shows up as this kind of noise. Many variables effect the amount of interference that would occur between existing CDMA units already operating in the newly reassigned band, and new TDMA/FDMA units placed into operation. Calculating the amount of interference for each combination of CDMA vs. TDMA/FDMA system should be left to the applicants. However some relevant, general observations can be made.

The majority of the equivalent noise power, as well as useful signal energy, in most CDMA signals occurs in the central 50% of their spectral emissions. For a typical BPSK signal, the value is approximately 83%. More to the point of this recommendation, the noise power in the outer 1.55 MHz, or the tails of a BPSK signal⁵ is about 4% of the total. This is the portion on each edge of the band into which the TDMA/FDMA systems would move. Expressed another way, each wing of a BPSK signal generated by a typical CDMA transmitter contains the energy of the equivalent of 1/50th of its total power. The interference this produces to a TDMA/FDMA receiver is further reduced by the ratio of the power that resides only in the FDMA bandwidth of a particular TDMA/FDMA channel. When adjusted to take this effect into account, for the one TDMA/FDMA applicant, the total noise power contribution in any one FDMA channel will be at most 1/200th to 1/250th of the power of a single CDMA carrier. In terms of dB, this is an increase of about -23 dB of noise. According to Motorola's filing, their system has some 15.5 dB of noise margin, mostly to overcome self-interference when the system operates in urban environments. The increase in background noise power caused by the sum of all grandfathered -23 dB interferers, in any particular spatial region, will not significantly degrade the quality of TDMA/FDMA system.

Based on our understanding of the operation of the one TDMA/FDMA system, there is great flexibility in the assignment of transmission channels. The only limitation of which we are aware is that the secondary allocation for space-to-earth use of the primary MSS/RDSS earth-to-space band is in the upper portion. Thus, we would propose that the TDMA/FDMA systems use only the upper portion of the band for their space-to-earth transmission. The lower and upper portion would be suitable for both earth-to-space use.

The effects of the TDMA/FDMA uplink transmissions on the grandfathered CDMA users in the reassigned region would be negligible, since the FDMA energy would essentially be spread over 8.25 MHz. This would cause an increased background noise for both the mobile terminals

⁵ Some proposed systems may use QPSK rather than BPSK modulation, but the practical effects are the same for both.

and the ground stations, but the total contribution will be small. The exception to this will occur when the TDMA/FDMA capacity limit is being approached and there is a significant use of all FDMA channels. This is unlikely to occur during the period in which the grandfathered terminals were in use.

The interference between a narrowband CDMA LEO system and an encroaching TDMA/FDMA system is less obvious, since more of the noise power of a narrowband CDMA signal will fall into the overlap region⁶. The respective system operators would have to determine whether three narrowband CDMA channels (1.25 MHz each, according to the GlobalStar application) would have to be removed as the bandwidth moved from CDMA use to FDMA use, or whether an arrangement could be reached where only two channels would be required to be removed.

Finally, MDC comments that, from a technical point of view, our system can utilize relay platforms at either GSO or LEO orbits. We do not see that one has inherent technical advantages over the other, and will choose the one that offers the best performance at the best price. While MDC would be pleased to purchase transponder capacity from a LEO system operator, and to offer our data and positioning services through them, we also do not believe that our customers would suffer in any way, or that our services would be less valuable, more costly, offer lower quality or performance, or in any other way be diminished if we continued to use GSO satellites as relays.

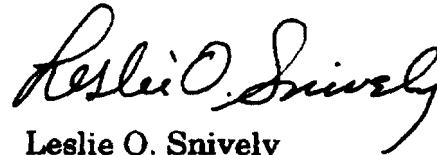
Of the claims made in the Notice about the advantages that low earth orbits offer over geostationary orbits, only the one concerning transmission delay time is valid. However, in terms of service, this only applies to uses of the spectrum for voice communication. A few specific claims are not wholly accurate. The claim that LEO systems offer additional options for system design such as lower power between the satellite and terrestrial equipment is not true. GSO satellites with larger antennas than those currently deployed also offer the opportunity for much lower user-to-satellite transmitter power. The FCC has several applications on file that support this assertion.

Also, the claim that Alaska has not been well served by GSO spacecraft does not match our experience. MDC has demonstrated that our data transmission system operates quite successfully for many applications up to at least 72° N (100 miles into the Arctic Ocean). While LEO systems offer some coverage advantages at high latitudes, and if available MDC use those advantages, we intend to offer a high quality service to customers in those regions in the years before the first LEOs are available.

In conclusion, MDC believes that the band sharing proposed in this submission offers a technically superior way to allow multiple systems to operate compatibly in the RDSS/MSS earth-to-space band compared to that

⁶ The amount will be closer to 15% in each wing. However, the narrowband FDMA channel use will reduce the noise contributions by an additional factor of 4 or 5.

proposed in the Notice. Our proposal reduces the economic impact imposed solely on the wideband CDMA applicants by the implementation proposed in the Notice. It also provides for a more equitable coordination burden on all applicants while decreasing the complexity of future modifications to the allocation. At the same time, it does not impose significant additional burdens on any applicants' system implementations.

A handwritten signature in black ink, reading "Leslie O. Snively". The signature is fluid and cursive, with the first name "Leslie" and last name "Snively" clearly distinguishable.

Leslie O. Snively

VP, System and Applications
Mobile Datacom Corporation